Pacific Ocean Perch – Widow Rockfish
STAR Panel
April 14-18, 2003
NWFSC, Seattle, WA

Review Report

By

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Executive Summary of findings and recommendations

Both assessments reviewed are state of the art in terms of modelling, but would be considered data-poor assessments in the North Atlantic, particularly in terms of fishery-independent indices of stock size. Compounding the problem of the paucity of fishery-independent stock size information, the fishery-dependent indices used in the widow rockfish assessments are unlikely to be reliable indicators of stock size. Fundamental assumptions about stock structure have not been tested to any extent, yet they have the potential to have considerable influence on future stock status. For example, the stock definitions assume that events in Canadian waters have no influence on stock status and trends in US waters. If in fact the real stock structure straddles the borders, as could very well be the case of Pacific Ocean Perch, events in the Canadian fishery could have substantial influence on the perceived status in US waters, and they could negate the effects of management measures implemented unilaterally in American waters without comparable actions in Canadian waters.

Members of the two Stock Assessment Teams (STAT) made efforts to be parsimonious in their model formulations, but my impression is that there is a tendency to over-fit the data.

The STAR appear to have considerable flexibility in completing the assessments, which is good from a scientific perspective. However, there is also a need for consistency in successive assessments, systematic comparisons of input data and assessment results, and it is also necessary to follow up on recommendations of previous Panels. Mechanisms should be put in place to ensure that such consistency and follow up does occur.

Modelling on the Pacific coast is generally considerably more elaborate than on the Atlantic coast. Nevertheless, modelling, however fancy and elaborate it gets, is no substitute for data. On the East coast, fishery-independent information is available from 2-3 scientific surveys per year, while here, similar information is available from single surveys conducted every three years. Confidence in the results of several assessments would be greatly enhanced if reliable indices of stock size were developed.

Background

Since 1997, the Pacific Fishery Management Council has used a stock assessment review process aimed at improving public participation in the process and enhancing scientific peer review, while providing clearer separation between the scientific and management processes. The process is known as Stock Assessment Reviews (STAR). Specific STAR Panels are tasked with reviewing the work done by one or more Stock Assessment Teams (STAT). The STAT are expected to prepare the assessments prior to the Panel meeting, and their work is distributed in advance of the Panel meeting to allow time for review.

The STAR Panel that met at the Northwest Fisheries Science Center (NWFSC) in Seattle April 14 – 18, 2003 was tasked with reviewing the assessments of Pacific Ocean Perch (POP) and widow rockfish. The previous assessments were completed in 2000. The assessments were scheduled for review by the Pacific Fisheries Management Council as part of the regular rotation of assessments. The STAT were either completely new (Pacific Ocean Perch) or had a new lead scientist (widow rockfish).

Review activities

Both draft assessments were received by e-mail on April 1, 2003. I reviewed them during the week of April 6. Travel to Seattle took place on April 13 and 14, arriving at the NWFSC just in time for the opening of the meeting in the afternoon of April 14. The review of widow rockfish was left open at the end of the meeting, and further discussions took place by e-mail after the meeting, particularly on April 24 and 25.

I volunteered to be rapporteur for the discussion on widow rockfish. Some of the findings below also appear in the Panel report.

Findings

Input data

Two main differences between assessments of North Atlantic fish stocks and those reviewed at the STAR meeting are striking: There is considerably more data, particularly indices of stock size, in the North Atlantic, but the modelling is considerably more advanced for the stocks reviewed. Perhaps one explains the other: In the absence of data on stock size, there is a greater need to do modelling in order to be able to provide advice for fishery management. In the North Atlantic, particularly for those stocks assessed by the Northeast Fisheries Science Center, it is not rare to have three fishery-independent (survey) indices of stock size each year. For widow rockfish, information is available from the triennial survey, but it is not used in the assessment. The POP assessment uses four surveys: Biomass estimates from the triennial survey split in two areas and the slope survey conducted each year since 1996, and age composition estimates for the combined Vancouver and Columbia area.

The attention paid to stock structure is another striking difference between the North Atlantic and the North Pacific side of North America. In the North Atlantic, considerable effort was spent in the 1950s and 1960s to identify management units that could be considered reasonably independent from one another. This led to stock definitions like cod in NAFO (North Atlantic Fisheries Organization) Division 4T and 4Vn (November to April) because the fish found in 4T during the summer migrate out of the area into 4Vn during the months of November to April. For the stocks reviewed, the Canada-U.S.A. border is considered the boundary of the stocks, assuming that events north of the border have no influence on the stock(s) and fisheries south of the border. However, the species do exist in Canadian waters where fisheries are exploiting them. The working hypothesis is that the Canadian fisheries have no influence on the resources in US waters, but the hypothesis has not been tested.

For widow rockfish, the fisheries are defined on the basis of different growth characteristics found by Lenarz (1987) and Pearson and Hightower (1991). It has not been verified if the conclusions of those papers continue to be valid with more recent, presumably more abundant data on growth and ageing.

Reliable information on proportions landed at age by gender for widow rockfish is available continuously from the early 1980s onward, while for POP, ageing information is considered reliable only for 1999-2002. For both species, age reading comparisons indicate very small variability in age determination, which suggests that either the otoliths are easy to read, or that the age comparison experiments somehow underestimated the real variability in age determination. For widow rockfish, sampling of the landings can be considered good (comparing table 1 of the draft assessment that provides landings and table 8 that provide the number of fish and samples collected for each year and fishery of age composition data used in the widow rockfish assessment). The combination of good sampling and low variability in age determination results in reasonably consistent estimates of year class contribution to landings, as shown in tables 4 to 7 of the widow rockfish draft assessment. There is reasonably high correlation, on a year class basis, for ages 6/7 to 13/14.

Compounding the problem of the lack of fishery independent indices of stock sizes, the reliability of the available fishery dependent indices is questionable. The catch per unit of effort calculated from logbooks for the Oregon bottom trawl fishery continues to be important in the assessment, because it does show a trend, even though landings have been so small that it has not been possible to calculate a catch-per-unit-effort (CPUE) index after 1999. The 2000 Panel expressed considerable doubts that the Oregon bottom trawl CPUE could be considered as a consistent index of stock size over the time period considered (1984-1999). Over that period, increases in fishing efficiency could be expected due to learning and technological innovations, while increasingly stringent management measures could be expected to have decreased efficiency. There is currently no way to quantify the effect of those changes. Two of the three CPUE indices derived from the by-catch in the whiting fishery do not cover recent years (that for the foreign fleet and that for the joint venture), while changes in regulations since 1999 imply that the index that could be derived from the domestic fishery whiting by-catch since 1999 cannot be considered comparable to earlier years because of voluntary initiatives to reduce by-catches of widow rockfish in the whiting fishery. In addition, the data have been filtered to exclude values greater than 5 tons per tow, as well as those that were greater than ± 2 standard deviations from the standardised values. Most of the other filtering criteria appear appropriate, but the exclusion of tows with catches greater than 5 tons or those outside $\pm$ 2 standard deviations (sd) from the standardised values have the potential of biasing the CPUE downwards, because the lower bound of the 2 sd is likely to be negative more often than not. Catches larger than 5 tons and those outside 2 sd should NOT be removed. It was not possible to re-do the data extraction and standardisation during the meeting, and the Panel concluded that it would be preferable to consider this request as a research recommendation for the next assessment of this stock.

For widow rockfish, there appears to be sufficient confidence in the reliability of the catch at age to do a backward VPA to verify the estimates of population size at age obtained by the statistical age-structured model.

The single fishery independent index of stock size for widow rockfish is scaled to represent 100 days old larvae / juveniles derived from a survey conducted by the Santa Cruz (formerly Tiburon) laboratory. The index is available annually for 1984 to 2002; but no juvenile widow rockfish were caught in 1992, 1994, and 1996 and the index could not be calculated for those years. For calibration purposes, half of the lowest non-zero value has been used for those years. The survey is conducted in a relatively small area compared to the area of distribution of widow rockfish, and there is little doubt that the value of the index can be influenced by a large number of factors other than those related to stock size. The base case adopted by the STAR Panel resulted in an anomalously large 1996 year class, although the index is not particularly large for that year. Based on e-mail discussions subsequent to the meeting, this no longer appears to be a problem.

Modelling

Compared with the evaluation of the input data and interpretation of the results, by far the largest portion of the Panel's time was spent discussing the specifics of model formulation, this was particularly the case for the Pacific Ocean Perch assessment where a (small) difference was found between the MCMC parameter estimates and the maximum likelihood ones. Several of the points discussed were also covered by the 2000 Panel.

For widow rockfish, there appeared to have been fewer contacts between the current STAT and the main author of the previous assessments, who no longer work at the same laboratory. As a result, all data were recompiled from raw data, and the model was re-coded to conform to available descriptions and model results. Given the paucity of stock size information, what were considered small changes in model formulation, resulted in unexpected changes in model results. Such sensitivity to relatively small changes calls for the collection of more stock size information.

Members of the two STATs made efforts to be parsimonious in their model formulations, but for someone with my training (based primarily in the North Atlantic), the STATs parsimony still meant estimating a lot of parameters. My impression is that there is a tendency to over-fit the data. With so many parameters fitted, it is difficult to critically examine if all parameters are in fact needed. In the widow rockfish, for example, the model formulation in the draft assessment included fitting yearly selectivities to four fishing fleets. When examined by time periods where changes in selectivities could have been expected due to changes in management measures and mesh size regulations, the selectivity estimates were not different for three of the fleets, and the difference for the fourth fleet were counterintuitive, i.e. higher selectivity of smaller fish size with larger meshes. In the end, selectivity was assumed not to vary with time, but only among fleets.

The interpretation of model behaviour is also complicated when so many parameters are fitted. For widow rockfish, catches of young fish in recent years are higher than for preceding years. Given the model formulation and lack of stock size information, the model may have attributed those higher catches to higher selectivity at smaller sizes (the counterintuitive results of the paragraph above) while in fact it could be due to increased recruitment.

The various CPUE used in the assessment are standardised using a Delta-generalised linear model. This is an improvement over the previous assessment in its ability to handle zero CPUE. The magnitude of the change from the nominal CPUE to the standardised CPUE however is not shown.

Process

The previous STAR Panel reports for the assessments reviewed were made available on the first day of the meeting. Receiving them earlier would have helped in preparing for the meeting. There were no systematic comparisons of input data and assessment results with previous assessments nor was there a systematic follow-up on recommendations of the previous panel. A systematic comparison helps understand the differences in results, if any, and a systematic follow-up on recommendations from previous panels should help improve the assessments.

Data were made available but not in a format that would have facilitated analysis. Little time was spent discussing the input data. In the North Atlantic, a reasonable portion of the review process is in fact a quality control on the data and methods. On the Pacific coast, possibly because data are fewer, the emphasis is more on the modelling aspects of trying to improve the fit to the few data available. The disproportionate amount of time spent on discussing model fit(s) tends to make participants forget the paucity of data, and consequently, the assessment results may be given more credibility than they deserve. Alternate model configurations, particularly for widow rockfish, produced relatively minor changes in assessment results, although some of these changes had severe implications for the rebuilding analyses. Investigating model formulations that produced drastically different population trends would provide a better perception of the uncertainties in the assessment.

Analysis, conclusions and recommendations

Considerable time is spent discussing model formulations and examining the fits to the (compared to northeastern North America) few data that are available. Yet, while the modelling is cutting edge, the data available for most stocks in the area are few and not sufficient to provide reliable estimates of recent trends and current stock size. Fundamental assumptions about stock structure have not been tested to any extent, yet they have the potential to exercise considerable influence on future stock status. For example, the stock definitions assume that events in Canadian waters have no influence on stock status and trends in USA waters. If in fact the real stock structure straddles the border, as could very well be the case for Pacific Ocean perch, events in the Canadian fishery could have substantial influence on the perceived status in USA waters, and they could negate the effects of management measures implemented unilaterally in American waters without comparable actions in Canadian waters. On the other hand, if the exchanges are in fact limited, management measures implemented in each jurisdiction may not affect stock and exploitation trends in the other. Obviously, the first step is to test for the possibility of exchanges using number of genetic analyses and other more traditional techniques, including tagging. Few Sebastes species have been tagged because their survival is low or close to nil when returned to the water after having brought up by trawls. However, Icelandic researchers have developed an in-situ tagging apparatus that appears to work reasonably well (http://www.star-oddi.com/underwater-tagging.htm). Should genetic studies be undertaken, care should be taken to choose a technique expected to provide reliable results (see reports of the ICES Stock Identification Methods Working Group http://www.ices.dk/iceswork/wgdetailacfm.asp?wg=SIMWG).

The assessment uses sex specific and area specific estimates for length-at-age from Pearson and Hightower (1991) based on differences in growth found by Lenarz (1987) and Pearson and Hightower (1991). Considerable ageing information has accumulated since those studies were done, and current information should be used to test if the differences still exist.

The STAT appear to have considerable flexibility in completing the assessments, which is good from a scientific perspective. However, there is also a need for consistency in successive assessments, systematic comparisons of input data and assessment results, and it is also necessary to follow up on recommendations of previous Panels. Mechanisms should be put in place to ensure that such consistency and follow-up does occur. In this context, the usefulness of the triennial survey as an index of stock size should be evaluated, as recommended by the previous Panel. Similarly, the straight average CPUE should be compared to the statistically standardised estimates. In the CPUE standardisation, vessels should be categorised (by tonnage or length) rather than treating each vessel as a category (as is currently done), and the number of geographical categories should be reduced.

Previous assessment documents and Panel reports are presumably available in electronic format, and it would have been useful to have had access to them ahead of the meeting. During the meeting, reviews would be enhanced if participants have access to the data (in a standardised format) on a local area network.

For widow rockfish, there is surprisingly good consistency in the age composition of the catch. If the catch at age is considered to be reliable, a backward VPA could provide useful information on past stock size and recruitment variability. Fishing mortality, however, is probably such a small fraction of total mortality that convergence may not occur.

Discussion of the widow rockfish by e-mail subsequent to the meeting confirmed the discomfort felt at the very end of the meeting with the base case, which implied that rebuilding was impossible with near zero fishing mortality. Although no rebuilding is not an impossible scenario, it is probably not the most likely scenario given the available information. The base case was arrived at through a logic-based process of eliminating options. Logic, however, does not guarantee correctness, particularly in data poor situations with considerable uncertainties. If logic leads to a dead end, we should not be afraid of backing up to the previous cross-roads and reconsidering our past decisions.

Modelling on the Pacific coast is generally more elaborate than on the Atlantic coast. Nevertheless, modelling, however fancy and elaborate, is no substitute for data. On the East coast, fishery-independent information is available from 2-3 scientific surveys per year, while on the Pacific coast, similar information is available from single surveys conducted every 3 years. Confidence in the results of several assessments would be greatly enhanced if reliable indices of stock size were developed.

Appendix 1 – Bibliography of material provided

Coastwide widow rockfish STAR Panel Meeting Report, 5-9, June 2000 (distributed at the meeting).

Groundfish stock assessment and review process during 2002 (handout distributed at the meeting).

Pacific Ocean Perch STAR Panel Meeting Report, 12-16, June 2000 (distributed at the meeting).

Hamel, O.S., Stewart, I.J., and Punt, A.E. 2003. Status and Future Prospects for the Pacific Ocean Perch Resource in Waters off Washington and Oregon as Assessed in 2003. Draft dated April 1, 2003

Xi, H., Ralston, S.V., MacCall, A.D., Pearson, D.E., and Dick. E.J. Status of the widow rockfish resource in 2003. Draft April 2003.

Appendix 2 – Statement of work

STATEMENT OF WORK

Consulting Agreement Between The University of Miami and Jean-Jacques Maguire

General

The consultant will participate in the Stock Assessment and Review (STAR) Panel of the Pacific Fishery Management Council (PFMC) from April 14 – 18, 2003, in Seattle, Washington. The STAR panel will review the Pacific Ocean Perch and Widow Rockfish stock assessments and will provide the basis for management of both fisheries.

The consultant's duties shall not exceed a maximum total of 14 days: Several days prior to the meeting for document review; the five-day meeting; and several days following the meeting to complete the written report. The report is to be based on the consultant's findings, and no consensus report shall be accepted.

The consultant will be provided with the following documents:

1. Draft Pacific Ocean Perch and Widow Rockfish assessment reports for 2003;
2. Most recent prior Pacific Ocean Perch and Widow Rockfish assessment reports;
3. Any prior STAR panel reports on Pacific Ocean Perch and Widow Rockfish assessments;
4. An electronic copy of the data, the parameters, and the model used for the assessment (if requested).

Specific

1) Become familiar with the current Pacific Ocean Perch and Widow rockfish stock assessments and background materials;
2) Participate in the STAR Panel to be held in Seattle, Washington, from April 14-18, 2003;
3) Understand the primary sources of uncertainty in the assessments;
4) Comment on the strengths and weaknesses of current approaches;
5) Recommend alternative model configurations or formulations as appropriate during the STAR panel;
6) No later than May 2, 2003, submit a written report[1] consisting of the findings, analysis, and conclusions, addressed to the "University of Miami Independent System for Peer Review," and sent to Dr. David Die, via email to ddie@rsmas.miami.edu, and to Mr. Manoj Shivlani, via email to mshivlani@rsmas.miami.edu.

Signed_____ Date_____

[1] The written report will undergo an internal CIE review before it is considered final. After completion, the CIE will create a PDF version of the written report that will be submitted to NMFS and the consultant.

ANNEX I: REPORT GENERATION AND PROCEDURAL ITEMS

1. The report should be prefaced with an executive summary of findings and/or recommendations.
2. The main body of the report should consist of a background, description of review activities, summary of findings, conclusions/recommendations, and references.
3. The report should also include as separate appendices the bibliography of all materials provided and a copy of the statement of work.

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